AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE, in Charge]

By L. T. SAMUELS

At those stations with a sufficient period of record for the determination of approximate normals, upper-air temperatures during December averaged below normal except in the lower levels at Seattle where the departures were positive. At the latter station and at Norfolk, however, the monthly means are based on only 9 and 16 observations, respectively. The lower values of the monthly mean temperatures at the upper levels in the eastern part of the country, as compared to western stations at corresponding latitudes, is evident in table 1. Upper-air relative humidity departures were positive, except at Pensacola and Norfolk where they were mostly negative.

Pronounced southerly components occurred in the directions of the upper-air wind resultants along the middle and northern Pacific coast, and a marked northerly component over the Lower Lakes region, as compared to the normal westerly direction. Resultant velocities were above normal over most of the southern and central stations and north Pacific coast, and below normal elsewhere. In most cases the resultant velocity departures were of only moderate magnitude.

TABLE 1.—*Mean free-air temperatures and relative humidities obtained by airplanes during December 1935*

TEMPERATURE (°C.)

Stations	Altitude (meters) m. s. l.																Number of observations
	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	
Barksdale Field (Shreveport), La.[1] (52 m)	2.0		3.3		3.5		2.8		1.4		0.2		−1.1		−5.2		−11.6		10
Billings, Mont.[2] (1088 m)	−1.5						2.0		−0.1		−2.9		−6.4		−12.3		−18.8		31
Boston, Mass.[1] (5 m)	−4.5	−1.8	−5.9	−2.5	−6.9	−2.3	−8.3	−2.7	−9.8	−2.9	−12.3	−3.6	−14.9	−3.9	−20.1	−4.2	−26.6	−4.7	23
Cheyenne, Wyo.[2] (1873 m)	−4.2						−1.4		−2.1		−5.2		−11.6		−18.6		−18.6		31
El Paso, Tex.[2] (1194 m)	3.7						6.4		5.3		3.1		1.2		−4.4		−10.4		31
Fargo, N. Dak.[2] (274 m)	−11.7		−10.9		−7.2		−6.5		−7.2		−9.0		−11.1		−16.6		−22.6		30
Kelly Field (San Antonio), Tex.[1] (206 m)	7.3		8.9		7.9		7.7		6.4		4.3		2.5		−3.0		−10.0		23
Lakehurst, N. J.[2] (39 m)	−2.6		−3.8		−6.0		−7.8		−9.0		−11.0		−13.2		−19.0				24
Maxwell Field (Montgomery), Ala.[1] (52 m)	2.2		4.2		4.1		3.6		2.6		0.7		−1.6		−7.7		−13.4		24
Mitchel Field (Hempstead, L. I.), N. Y.[1] (29 m)	−3.0		−5.4		−7.3		−8.7		−10.2		−12.4		−14.6		−20.2		−26.8		26
Murfreesboro, Tenn.[2] (174 m)	0.7		1.4		0.8		−0.2		−0.9		−2.9		−5.6		−10.6		−17.1		22
Norfolk, Va.[2] (10 m)	3.4	−0.8	1.9	−1.7	0.1	−2.0	−2.0	−3.0	−4.3	−4.1	−6.2	−4.1	−7.7	−3.7	−12.3	−3.1	−18.6	−3.8	16
Oklahoma City, Okla.[2] (391 m)	1.7		3.0		3.6		2.4		0.7		−1.3		−3.8		−8.7		−15.1		28
Omaha, Nebr.[2] (300 m)	−4.2	+0.2	−4.1	−0.5	−4.0	−2.1	−3.8	−3.0	−4.7	−2.9	−6.8	−2.9	−9.1	−2.9	−14.5	−2.5	−20.3	−1.9	31
Pearl Harbor, Territory of Hawaii[3] (6 m)	21.3	−2.2	20.5	−0.2	16.8	−0.2	13.9	−0.5	12.5	0.0	11.0	+0.3	8.5	+0.1	2.5	−0.2			31
Pensacola, Fla.[3] (24 m)	4.9	−4.5	6.4	−3.5	7.0	−2.6	6.1	−2.4	4.4	−2.8	2.5	−2.7	0.4	−2.6	−4.0	−2.2	−9.8	−2.2	28
San Diego, Calif.[3] (10 m)	8.9	−3.1	12.2	−0.9	10.9	−1.4	8.3	−1.8	5.9	−2.0	3.5	−1.9	0.8	−2.1	−5.4	−2.3	−11.3	−2.2	31
Scott Field (Belleville), Ill.[1] (135 m)	−4.7		−4.0		−4.1		−4.2		−4.8		−6.6		−7.9		−13.1		−18.5		20
Seattle, Wash.[2] (25 m)	5.5	+0.2	5.7	+1.5	4.9	+1.9	3.2	+2.3	0.9	+2.5	−1.9	−2.7	−4.6	−2.9	−10.7	−2.8	−17.4	−3.1	9
Spokane, Wash.[2] (596 m)	−1.1				0.2		1.1		1.4		0.1		−2.1		−8.0		−15.1		25
Washington, D. C.[2] (13 m)	0.8	−0.6	−0.6	−2.0	−3.3	−3.5	−5.0	−4.0	−6.9	−4.7	−8.4	−4.2	−10.6	−5.0	−15.3	−5.2	−20.7	−5.4	20
Wright Field (Dayton), Ohio[1] (244 m)	−6.4		−5.9		−6.3		−7.1		−8.4		−10.1		−11.8		−15.4		−20.9		21

RELATIVE HUMIDITY (PERCENT)

Barksdale Field (Shreveport), La.	70		60		51		52		52		49		44		31		33		
Billings, Mont.	65						55		54		56		61		60		55		
Boston, Mass.	70	−1	72	+3	73	+6	68	+5	64	+6	66	+10	65	+10	60	+6	54	+4	
Cheyenne, Wyo.	63								57		51		52		49		48		
El Paso, Tex.	72						60		55		52		42		35		29		
Fargo, N. Dak.	83		85		72		63		57		53		48		47		42		
Kelly Field (San Antonio), Tex.	84		66		61		59		54		49		41		34		38		
Lakehurst, N. J.	69		67		69		64		60		57		53		49				
Maxwell Field (Montgomery), Ala.	73		61		53		46		38		34		33		32		33		
Mitchel Field (Hempstead, L. I.), N. Y.	80		80		78		72		68		66		61		53		52		
Murfreesboro, Tenn.	81		74		68		59		48		43		39		42		43		
Norfolk, Va.	64	−6	61	−1	57	−1	53	+1	51	+5	48	+3	39	−4	27	−10	25	−7	
Oklahoma City, Okla.	80		75		63		58		53		50		45		41		39		
Omaha, Nebr.	85	+1	83	+4	75	+9	65	+11	58	+9	51	+5	49	+5	47	+3	47	+5	
Pearl Harbor, Territory of Hawaii	84	+8	80	+3	84	+5	78	+5	62	−1	46	−6	38	−6	33	−5			
Pensacola, Fla.	83	+1	69	−4	55	−9	45	−12	42	−9	39	−10	35	−11	27	−10	33	−5	
San Diego, Calif.	88	+17	69	+9	55	+6	49	+6	45	+7	40	+7	34	+5	32	+5	30	+6	
Scott Field (Belleville), Ill.	83		74		72		66		55		50		46		45		43		
Seattle, Wash.	86	+5	75	0	68	−1	62	−1	62	+2	55	+1	51	+3	44	+1	43	−1	
Spokane, Wash.	89				90		73		62		58		55		51		48		
Washington, D. C.	71	0	67	+3	67	+8	69	+13	65	+14	61	+14	56	+12	55	+12	48	+9	
Wright Field (Dayton), Ohio	81		80		79		70		64		60		54		53		51		

Observations taken about 4:00 a. m., 75th meridian time, except along the Pacific coast and Hawaii where they are taken at dawn.

[1] Army. [2] Weather Bureau. [3] Navy.

NOTE.—The departures are based on "normals" covering the following total number of observations made during the same month in previous years, including the current month: Boston, 83; Norfolk, 101; Omaha, 146; Pearl Harbor, 108; Pensacola, 145; San Diego, 159; Seattle, 31; Washington, 164.

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during December 1935*

[Wind from N=360°, E=90°, etc.]

Altitude (m) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (153 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (274 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Murfreesboro, Tenn. (180 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	342	1.5	321	2.7	254	3.7	301	3.6	285	4.7	277	1.4	278	1.8	296	4.2	301	0.2	40	2.0	26	2.3	94	0.2	288	0.8
500	-----	-----	327	4.2	-----	-----	322	7.1	-----	-----	299	3.3	275	4.4	309	7.1	275	1.5	101	2.0	44	3.4	89	0.7	299	3.8
1,000	-----	-----	311	7.2	-----	-----	316	6.9	-----	-----	291	4.4	281	4.7	310	6.6	310	6.3	214	1.5	15	0.3	149	5.6	303	5.7
1,500	-----	-----	294	9.9	271	7.2	298	7.5	-----	-----	305	5.4	280	6.2	304	5.2	318	7.2	273	4.6	285	2.3	181	4.6	297	7.2
2,000	335	2.7	284	10.5	295	7.6	288	9.0	287	7.1	303	6.9	280	8.5	321	7.5	319	11.4	281	6.8	278	5.0	208	5.7	293	9.6
2,500	306	3.4	287	13.4	297	8.7	283	8.8	300	10.7	318	7.7	296	9.1	325	7.3	332	12.9	287	8.7	288	6.7	217	5.8	301	9.3
3,000	301	5.4	269	13.1	295	9.3	289	7.0	308	11.2	328	10.0	-----	-----	-----	-----	-----	-----	283	10.8	288	7.9	203	4.6	295	10.1
4,000	292	8.6	-----	-----	293	10.1	-----	-----	308	9.8	-----	-----	-----	-----	-----	-----	-----	-----	262	14.4	258	7.8	218	1.5	-----	-----
5,000	296	12.9	-----	-----	323	5.6	-----	-----	297	3.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	290	4.7	-----	-----

Altitude (m) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii [1] (68 m)		Pensacola, Fla.[1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	304	2.4	116	0.8	59	0.2	288	0.7	54	2.3	23	3.9	277	1.8	138	2.4	71	1.4	68	1.5	161	2.3	254	0.3	294	2.9
500	307	7.7	76	1.0	360	1.6	297	2.1	86	3.9	8	3.1	284	4.7	-----	-----	38	1.0	58	1.3	184	7.3	-----	-----	305	8.7
1,000	307	7.8	181	0.9	318	5.1	294	5.2	89	4.4	300	5.3	296	7.1	-----	-----	12	1.6	326	2.9	202	7.6	128	2.4	313	10.6
1,500	308	8.9	229	2.0	307	7.2	300	6.7	94	2.8	294	8.4	297	8.1	158	2.8	352	2.1	317	2.4	208	8.0	178	3.7	309	11.3
2,000	296	9.7	243	2.0	312	9.7	305	8.5	103	2.1	291	11.3	299	9.3	181	2.6	321	1.6	-----	-----	210	7.4	219	3.3	292	12.7
2,500	307	10.8	242	2.6	304	11.7	308	7.9	115	2.6	288	13.8	296	9.6	249	2.0	322	2.0	-----	-----	208	6.0	248	5.4	281	11.2
3,000	-----	-----	252	3.3	307	11.8	307	10.6	273	2.2	281	15.5	306	12.1	287	2.8	312	3.2	-----	-----	212	7.2	261	6.0	-----	-----
4,000	-----	-----	235	3.4	284	14.2	-----	-----	-----	-----	272	22.0	-----	-----	304	4.3	290	4.2	-----	-----	226	8.0	-----	-----	-----	-----
5,000	-----	-----	251	6.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	290	6.6	293	5.5	-----	-----	-----	-----	-----	-----	-----	-----

[1] Navy stations.

AEROLOGICAL OBSERVATIONS FOR THE YEAR 1935

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By L. T. SAMUELS

Only those stations having a record of 1 year or nearly 1 year are included in table 1. The length of period on which the normals are based at those stations for which departures are indicated is shown at the bottom of table 1.

Airplane weather observations were discontinued at Boston by the Massachusetts Institute of Technology during May, and resumed there by the War Department on August 1. On June 15, that Department began observations at Barksdale Field, Shreveport, La. Airplane weather observations were discontinued at Sunnyvale, Calif., during October when the Navy Department moved its flying activities from that field. Airplane observation stations were established at El Paso, Tex., and Spokane, Wash., on July 1, by the Weather Bureau under contract with a commercial operator; the Washington State National Guard had made these flights for the Weather Bureau during the preceding fiscal year.

The total number of pilot-balloon stations in operation by the Weather Bureau at the end of 1935 was 77 (an increase of 1 over the previous year), including 3 stations in Alaska and 1 in Puerto Rico.

During the International month of June, the Weather Bureau released 33 sounding balloons at Omaha, Nebr. Twenty-eight (85 percent) of the meteorographs have been found and returned to date.

Cooperation between the Weather Bureau and the National Bureau of Standards was maintained during the year, in the development of radio-meteorographs for use with sounding balloons, and considerable progress was made.